Mozambique – market opportunities for bioenergy

In focus

- The primary energy resource in Mozambique is the traditional use of biomass, 75% of the total energy consumption;
- About 15% of the population has access to electricity in the country;
- Mozambique is a promising country for sustainable biomass production because of its large availability of land and favourable environmental conditions for agricultural production;
- Agriculture is subsistence oriented; smallholder agricultural productivity is low;
- Forest regulation is weak and often conflicting; governmental control over resources is limited;
- Mozambique has an ambitious policy on renewable energy.

Key figures 2011: (*2011 est., **2012 est.)

<table>
<thead>
<tr>
<th>Indicator</th>
<th>Value</th>
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<tbody>
<tr>
<td>GDP</td>
<td>23.87 billion US$*</td>
</tr>
<tr>
<td>Real GDP growth</td>
<td>7.7%</td>
</tr>
<tr>
<td>GDP per capita (PPP)</td>
<td>1,100 US$*</td>
</tr>
<tr>
<td>Contribution agriculture to GDP</td>
<td>28.4%*</td>
</tr>
<tr>
<td>Inflation rate</td>
<td>9.2%</td>
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<tr>
<td>Population</td>
<td>22.9 million people</td>
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The Netherlands is an important partner of Mozambique. NL Agency Sustainable Biomass Programmes and NL Agency International EVD support entrepreneurs deploying sustainable bioenergy projects.

Potential markets: Key facts

Production biofuels
- Currently there are two small ethanol plants in the country for domestic consumption;
- The Mozambican government has received 34 biofuel investment proposals from 2008 to end of 2011 targeting a total production area of 341,858.00 ha. Most of it to be developed in the provinces of Sofala (27%), Zambezia (27%) and Manica (14%);
- Until April of 2012, eight of these proposals have been officially approved (CEPAGRI, 2012);

Production bioenergy
- Firewood and charcoal production was estimated at 22 million tons per year in 2007; 70% of this is used to meet basic energy needs of the population;
- The urban charcoal market in Maputo, Beira and Nampula is estimated to an annual turnover of over 250 million US$; less than 5% of this market is within the formal sector;
- Reported charcoal prices (2012) range from 13 US$ in Beira to 26 US$ in Maputo for a 70 kg sac;
- A number of biofuel facilities use sugar cane bagasse and jatropha seedcake for electricity.

Land use:
- The total area size of Mozambique is 799,380 sq km;
- Closed and open forests occupy more than half of the country’s land;
- About 16% of the country is mosaic cropland. 5.5% of the country is arable land. Only a small part of this is cultivated with permanent crops, the rest is under shifting cultivation.
Key developments in Mozambique

Three steps characterize the typical bioenergy chains: feedstock production, logistics and conversion. Identification of their potential and limitations is crucial for a successful project.

1 Feedstock production

Biomass from forestry
- Total wood demand can be differentiated in demand for woodfuel (93%) and demand for industrial round wood (7%);
- A large part of the logged industrial round wood is currently exported;
- Wood for fuels is typically harvested in a largely uncontrolled way;
- Inefficient use of wood for fuel production results in over-exploitation of forest stocks.

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<tbody>
<tr>
<td>Natural forest</td>
<td>40055</td>
<td>38960</td>
</tr>
<tr>
<td>Planted forest</td>
<td>24</td>
<td>62</td>
</tr>
<tr>
<td>Other wooded land</td>
<td>14711</td>
<td>14566</td>
</tr>
</tbody>
</table>

The estimated growing stock of forest plantations is 150 m3/ha (FRA, 2010).

Biomass from Agriculture
- A recent land zoning assessment carried out by the government identified 6,966,030 ha of available land; 54% of this land is suitable for large-scale agricultural projects including biofuels;
- 3,441,784 tonnes of sugar cane were milled in 2011 (389,425 tonnes of sugar and 144,940 tonnes of molasses);
- Yields of energy crops in Mozambique that are promoted in the Biofuels Policy and Strategy (2009) are:

<table>
<thead>
<tr>
<th>Energy crop</th>
<th>Yield (ton/ha)</th>
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<tbody>
<tr>
<td>Sugar cane</td>
<td>71.8 (2011/2012)**</td>
</tr>
<tr>
<td>Sweet sorghum</td>
<td>0.64 (for sorghum)*</td>
</tr>
<tr>
<td>Jatropha</td>
<td>1.5 – 2.5 t Jatropha oil/ha***</td>
</tr>
<tr>
<td>Coconut</td>
<td>3.35*</td>
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</table>


The Biofuels Policy and Strategy will be revised in 2013 and may consider other energy crops;
- Other important agricultural products are cotton, cashew nuts, sugarcane, cassava (tapioca), corn, coconuts, and sunflowers.

Estimated biomass potential from agricultural waste
- The estimated residue energy potential available for 2006 was 128 PJ, sugar cane and maize were the dominant crops;
- Production of bagasse in 2011 was approximately 998,000 tons. Some pulp is used in sugar factories for energy production;
- Competition of residues for other uses limits the current use of agricultural waste.

Relevant trends and theoretical potential
- Predictions in availability of land for 2030 for bioenergy production range between 6.4 for the Business as Usual scenario to 16.5 million ha if agricultural practices significantly improve;
- Less than 15% of the government approved area for biofuels has been planted by the end of 2011;
- Studies indicate considerable possibilities to improve agricultural and forest plantation productivities.

2 Logistics

Infrastructure expansion and improvement is a priority of the government of Mozambique; despite improvements in the last years, infrastructure in Mozambique is still limited.

Road transport
- The main road network is North-South directed; East-West networks connect Mozambique with its neighbouring countries;
- Most roads are not paved and the condition of trucks is generally poor, therefore transport for long distances is expensive;
- Long transport distances are expensive and time consuming.

Rail transport
- The railway system is not extensive and not interconnected (4787 km with 5 main railroads for transporting cargo);
- Costs for railway transport and reloading are relatively high, worth it only for long distances.

Air transport, sea transport and waterways
- There are six ports in Mozambique. Maputo, Beira and Nacala serve the international trade; Pemba and Quelimane serve mainly domestic cargos;
- There are 460 km of waterways (Zambezi River navigable to Tete and along Cahora Bassa Lake);
- Mozambique has 23 airports with paved runways and 83 with unpaved runways.
3 Conversion

- The country has four major commercial sugar cane companies and two small ethanol plants for domestic consumption;
- There exists an embryonic biodiesel sector using coconut oil, and occasionally palm oil as feedstock;
- The approved proposals by the Mozambican government include two sugar cane and sweet sorghum ethanol projects requiring 33,000 ha of land to produce 220 million litres per year;
- The government promotes the use of bagasse and jatropha seedcake for generating electricity;
- Approved proposals also include five Jatropha biodiesel projects requiring 29,504 ha of land;
- Projects promote the introduction of clean, more efficient cooking stoves using ethanol or the sustainable production of briquettes through pyrolysis;

Map: Geographical spread of biofuel developments in Mozambique based on Schut et al (2010)

Business opportunities and experiences

Investment climate

Strong economic growth has been achieved last decade: GDP growth was estimated 7.7% in 2011. Still, about 54% of the population lives in poverty today. Foreign Direct Investment increased from around 427.4 million US$ in 2007 to 789 million US$ in 2010. A total investment of 1055 US$ million in planned biofuel projects was estimated in 2010. However, projects experience delays or are cancelled.

Triggers for investment
- Available land with suitable environmental conditions;
- Strategic geographical location for international trade;
- Access to energy and continuing economic growth guarantees a growing energy market;
- Progressive and ambitious policies on bioenergy.

Things to remember
- Define the project’s competitive edge;
- Ensure capital for long term investment projects;
- Explore opportunities and start your business in Mozambique, not from a distance;
- Be aware of limited availability of infrastructure and logistics;
- Understand crop management knowledge and skills, especially for smallholder projects;
- Be aware of the extensibility of time (be flexible);
- Obtain a full understanding of legal procedures and policies;
- Build up a network of contacts and understand your partners' culture and position.

Projects funded by Sustainable Biomass Programmes

Three sustainable biomass projects are supported by NL Agency:
- Towards Sustainability certification of Jatropha Biofuels in Mozambique: Capacity building for certification of Jatropha biofuels through a benchmark between existing sustainability criteria frameworks;
- Sustainable solid biomass supply from Mozambique: Development of a certified biomass supply chain from agricultural by-products and short rotation coppiced trees from smallholder producers, and evaluation of the feasibility of torrefaction under Mozambican circumstances;
- Certification system addressing indirect impacts (iLUC) of biofuels: develop and field-test a certification module for sustainable biofuel feedstock production that prevents displacement of food/feed production.

More information is available from the NL Agency website under projects.
**Biomass and sustainability**

- Between 2000 and 2005, deforestation in Mozambique was roughly 50,000 hectares per year;
- Important drivers are woodfuel demand, its low prices and a growing population, with a need for agricultural land. Uncontrolled large commercial investments in agriculture may become a serious threat as well.
- Woodfuel from sustainable forest management has difficulty to compete on the market with low woodfuel prices from uncontrolled exploitation;
- The need for the formulation of sustainability criteria is recognized by the government’s strategic framework for biofuels;
- The first version (2010) of the Mozambican Biofuel Sustainability Framework includes seven principles: i) legality, ii) social responsibility, iii) energy security, iv) macro-economic benefits and economic and financial viability, v) food security, vi) agricultural productivity and vii) environmental protection;
- The Biofuel Sustainability Framework is to be integrated in the government’s Project application and land acquisition process in the coming year.

**To take into consideration when developing a project:**

- Carry out a decent social and environmental impact assessment before the start of a project;
- Invest in community relations and stakeholder consultation;
- Promote local benefits and rural development;
- Comply with the sustainability criteria as developed by the government of Mozambique;
- Promote community forest management with equitable revenue sharing along the value chain.

**Initiatives:**

- Private sector professional on certification are developed in Mozambique;
- Three FSC certificates on sustainable forest management have been provided until May 2012;
- The Jatropha Alliance conducted a study on suitable sustainability standards for jatropha production in Mozambique; RSB was considered to be the most suitable;
- One of the pilots for testing the standard of the International Wood Pellet Buyers Initiative (IWPBI) is conducted in Mozambique.

**Projects supported by NL Agency Sustainable Biomass Programmes**

**Project experiences:**

**Triple bottom line torrefied biomass supply chain from Mozambique**

GDF Suez and Solidaridad work together to develop a certified supply chain from smallholder producers in the country. The project also includes an evaluation of the feasibility of torrefaction under Mozambican characteristics. Outputs of the project are two bankable business plans for torrefied biomass: one for the local market and one for export. The team has identified short rotation coppice, agroforestry and sawmill residues as suitable biomass sources to supply the local charcoal market in Beira. 90% of the people in this region depend on local biomass for energy, demand and prices are high: even higher than the export market. Encroaching bamboo is identified as sustainable biomass resource for the export chain. This may offer a win-win situation for the project and for small-scale farmers. Bamboo is currently being tested on its suitability for torrefaction and the supply chain is being used as pilot for the sustainability principles from the Industrial Wood Pellets Buyer Initiative (IWPBI).

**Why Mozambique?**

Mozambique was selected because of its abundance of natural resources and excellent location of ports.

**What are the lessons learnt?**

Although theoretical potentials are high, the project experienced difficulty in finding sufficient underutilized biomass that matches the required minimum scale for export. An advice for biomass project developers in Mozambique is to take notice of the challenging environment to set up a supply chain; by instance, infrastructure is limited, there is lack of qualified people, and legislation for the shipping torrefied biomass is complicated. The team recommends therefore to “start small and think big”: Start step by step with the development of a small local-to-local supply chain, followed by up-scaling for possible export. This way, lessons learnt can be continuously integrated in the further implementation of the project.
**Project: Recommendation to go towards Sustainability Certification of Jatropha Biofuels**

Jatropha Alliance and Partners for Innovation have carried out the project ‘Towards Sustainability Certification of Jatropha Biofuels in Mozambique’. After a review of 44 sustainability standards, from which eleven have been analyzed in-depth, the team selected the sustainability standard of the Roundtable on Sustainable Biofuels (RSB) as the most suitable one for the project. A gap analysis was conducted at three Jatropha plantations to identify in how far the companies reach compliance with RSB and what kind of actions would be needed if compliance with specific principles was not achieved.

**Why Mozambique?**

Mozambique was selected because of its advanced government policy on biofuels, existing cooperation and contacts in the country, and for the suitability of the country to grow Jatropha.

**What are the lessons learnt?**

Project recommendations for companies aiming for sustainability assessment in the business set-up and land acquisition stage include:

- Ask a competent contractor for the environmental and social impacts assessment, and undertake this assessment in line with international standards;
- Carry out a genuine stakeholder consultation and document the stakeholder process thoroughly and continuously;
- Assess the carbon stock of the land before acquisition;
- Make sure your business plan is realistic and viable in the long run, balancing economic, social and environmental aspects.

The results of the project were used by RSB and the Jatropha sector to learn about the practical application of the sustainability standard.

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**Relevant policies**

<table>
<thead>
<tr>
<th>Energy and climate</th>
<th>Transport</th>
<th>Agriculture</th>
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<tbody>
<tr>
<td>• Decreased dependence on oil imports;</td>
<td>• National Biofuel Policy and Strategy approved since 2009;</td>
<td>• Agricultural investment projects require approval from the government;</td>
</tr>
<tr>
<td>• Enhanced energy security;</td>
<td>• Obligatory blending introduced in Mozambican biofuels regulation (2012);</td>
<td>• Four non-food energy crops are selected in the Biofuels Strategy: sugar cane and sweet sorghum for bioethanol and coconut and jatropha for biodiesel;</td>
</tr>
<tr>
<td>• Improve energy access in the country;</td>
<td>• Bioethanol targets: E10 (2012-2015), E15 (2016-2020) and E20 after 2021;</td>
<td>• A land zoning assessment indicates which land is available for agricultural projects including cultivation of biofuel crops.</td>
</tr>
<tr>
<td>• Limit the impacts of climate change by sustainable management of resources;</td>
<td>• Biodiesel targets: B3 (2012-2015), B7.5 (2016-2020) and B10 after 2021</td>
<td></td>
</tr>
<tr>
<td>• The policy framework for the biomass sector for energy is still to be developed;</td>
<td>• Biofuel projects need to be demonstrably sustainable. An operating framework is under development.</td>
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<tr>
<td>• The government is currently drafting its biomass energy strategy (due in 2013)</td>
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**Public support for project development and bioenergy**

**Supporting sustainable biomass Mozambique**

Financial incentive systems form part of the strategic framework of the Mozambican government to promote the national economy including, but not restricted to, the development of a bioenergy market:

- Incentives are provided to economic operators under the Investment Law and Code of Fiscal Benefits;
- Special duty free zones have been created in industrial areas near big cities;
- The government is considering the establishment of tariffs for the purchase of renewable electricity;

**Supporting sustainable biomass Netherlands**

NL Agency has a vast network of contacts and can provide information based on many years of experience in supporting projects on biomass and energy. It offers entrepreneurs support and information.

The Netherlands, with Wageningen University as implementing partner, is working with the Centre for Promotion of Agriculture (CEPAGRI) to strengthen capacity. Support is also provided to the Mozambican Inter-ministerial Subgroup Sustainability Criteria to develop and implement a biofuel sustainability framework [http://bit.ly/164qQ7](http://bit.ly/164qQ7). The Competing Claims program ([http://bit.ly/IVfIJA](http://bit.ly/IVfIJA)) contributes in understanding the impacts of biofuel developments on resource use negotiations and rural livelihoods.

**Role of innovation, science and technology**

**Key universities in Mozambique and cooperation programmes**

- University Eduardo Mondlane, [http://www.uem.mz/](http://www.uem.mz/)

**Universities involved in NL Agency’s sustainable bioenergy programmes**

- University of Utrecht, [www.uu.nl](http://www.uu.nl)
- University of Wageningen, [www.wur.nl](http://www.wur.nl)
The Netherlands Programmes Sustainable Biomass (NPSB) bundle and dissemi-
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The project portfolio for NPSB consists of the Global Sustainable Biomass Fund
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Relevant other contacts

Contacts that can help companies entering the Mozambican bioenergy market include:

- NL Agency: www.agentschapnl.nl
- Netherlands Embassy in Mozambique, http://mozambique.nlembassy.org/

Relevant ministries and government agencies involved:

- Investment Promotion Centre (CPI), www.cpi.co.mz/
- Ministry of Energy (ME), www.me.gov.mz
- Centre for the Promotion of Agriculture (CEPAGRI), http://www.cepagri.gov.mz/
- Ministry of Coordination of Environmental Affairs (MICOA), www.micoa.gov.mz
- Ministry of Agriculture (MINAG), http://www.minag.gov.mz/

NGOs and others involved in NL Agency’s sustainable bioenergy programmes

- Solidaridad, http://www.solidaridad.nl/

NL Agency offers support

- Knowledge centre
  Extensive knowledge and information is available to answer your questions on bioenergy, Mozambique and related topics. Project reports and presentations are available on request.
- Support
  Various programmes are developed to support innovative pilot projects, joint-investments, and transfer of technology, knowledge and skills in social and economic sectors.
- Network
  Matchmaking to link new initiatives and private businesses in Mozambique to establish links with Dutch companies, to establish networks and to exchange knowledge and information.
- Contact:
  duurzamebiomassamondiaal@agentschapnl.nl

The Global Sustainable Biomass Fund is commissioned by the Ministry of Foreign Affairs and implemented by NL Agency.

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